1. **Anisotropic magnetoresistance driven by surface spin orbit scattering**
   Steven S.-L. Zhang, Giovanni Vignale, Shufeng Zhang
   arXiv:1504.03310

   In a bilayer consisting of an insulator (I) and a ferromagnetic metal (FM), interfacial spin orbit scattering leads to spin mixing of the two conducting channels of the FM, which results in an unconventional anisotropic magnetoresistance (AMR). We theoretically investigate the magnetotransport in such bilayer structures by solving the spinor Boltzmann transport equation with generalized Fuchs-Sondheimer boundary condition that takes into account the effect of spin orbit scattering at the interface. We find that the new AMR exhibits a peculiar angular dependence which can serve as a genuine experimental signature. We also determine the dependence of the AMR on film thickness as well as spin polarization of the FM.

2. **Spin Textures of Polariton Condensates in a Tunable Microcavity with Strong Spin-Orbit Interaction**
   S. Dufferwiel, F. Li, E. Cancellieri, L. Giriunas, A. A. P. Trichet, D. M. Whittaker, P. M. Walker, F. Fras, E. Clarke, J. M. Smith, M. S. Skolnick, D. N. Krizhanovskii
   arXiv:1504.02341

   We report an extended family of spin textures in coexisting modes of zero-dimensional polariton condensates spatially confined in tunable open microcavity structures. The coupling between photon spin and angular momentum, which is enhanced in the open cavity structures, leads to new eigenstates of the polariton condensates carrying quantised spin vortices. Depending on the strength and anisotropy of the cavity confinement potential and the strength of the spin-orbit coupling, which can be tuned via the excitonic/photonic fractions, the condensate emissions exhibit either spin-vortex-like patterns or linear polarization, in good agreement with theoretical modelling.

3. **Majorana Fermion Surface Code for Universal Quantum Computation**
   Sagar Vijay, Timothy H. Hsieh, Liang Fu
   arXiv:1504.01724

   We introduce an exactly solvable model of interacting Majorana fermions realizing Z2 topological order with a Z2 fermion parity grading and lattice symmetries permuting the three fundamental anyon types. We propose a concrete physical realization by utilizing quantum phase slips in an array of phase-locked s-wave superconducting islands on a topological insulator surface. Our model finds a natural application as a Majorana fermion surface code for universal quantum computation, with a single-step stabilizer measurement requiring no physical ancilla qubits, increased error tolerance, and simpler logical gates than a surface code with bosonic physical qubits. We thoroughly discuss protocols for stabilizer measurements, encoding and manipulating logical qubits, and gate implementations.

4. **Majorana Fermions: Direct Observation in 3He**
   Yury Bunkov, Rasul Gazizulin
   arXiv:1504.01711

   In this letter we report the first direct observation of gap-less Majorana QPs which appear as Andreev bound states on the surface of superfluid 3He-B. We made the precise measurements of superfluid 3He-B heat capacity at the limit of extremely low temperatures. We have

separated the heat capacity of bulk Bogolyubov QPs and the surface Majorana QPs by its different temperature dependence. We have found that at 0.12 mK the Majorana fermions constitute a part of about 30/100 of bulk 3He-B heat capacity at the conditions of our experiments.

5. **General response theory of topologically stable Fermi points in the presence of disorders**
Y. X. Zhao, Z. D. Wang
arXiv:1504.02373

We develop a general response theory of gapless Fermi points with nontrivial topological charges, which asserts that the topological character of the Fermi points is embodied as the terms with discrete coefficients proportional to the corresponding topological charges. Applying the theory to the effective non-linear sigma models for topological Fermi points with disorders in the framework of replica approach, we derive rigorously the Wess-Zuminio terms with the topological charge being their levels in the two complex symmetry classes of A and AIII. In particular, a Wess-Zuminio-Witten model, as a conformal field theory, is shown to be an exact result for a two-dimensional Dirac point under disorders respecting the chiral symmetry. We also address a qualitative connection of topological charges of Fermi points in the real symmetry classes to the topological terms in the non-linear sigma models, based on the one-to-one classification correspondence.

6. **Decoherence from classically undetectable sources: A standard quantum limit for diffusion**
C. Jess Riedel
arXiv:1504.03250

In the pursuit of speculative new particles, forces, and dimensions with vanishingly small influence on normal matter, understanding the ultimate physical limits of experimental sensitivity is essential. Here, I show that quantum decoherence offers a window into otherwise inaccessible realms. There is a standard quantum limit for diffusion that restricts some entanglement-generating phenomena, like soft collisions with new particle species, from having appreciable classical influence on normal matter. Such phenomena are *classically undetectable* but can be revealed by the anomalous decoherence they induce on non-classical superpositions with long-range coherence in phase space. This gives strong, novel motivation for the construction of matter interferometers and other experimental sources of large superpositions, which recently have seen rapid progress. Decoherence is always at least second order in the coupling strength, so such searches are best suited for soft, but not weak, interactions.

7. **Work measurement in an optomechanical quantum heat engine**
Ying Dong, Keye Zhang, Francesco Bariani, Pierre Meystre
arXiv:1504.02901

We analyze theoretically the measurement of the mean output work and its fluctuations in a recently proposed optomechanical quantum heat engine [K. Zhang *et al.* Phys. Rev. Lett. **112**, 150602 (2014)]. After showing that this work can be evaluated by a continuous measurements of the intracavity photon number we discuss both dispersive and absorptive measurement schemes and analyze their back-action effects on the efficiency of the engine.

Both measurements are found to reduce the efficiency of the engine, but their back-action is both qualitatively and quantitatively different. For dispersive measurements the efficiency decreases as a result of the mixing of photonic and phononic excitations, while for absorptive measurements, its reduction results from photon losses due to the interaction with the quantum probe.

8. **On the Importance of Interpretation in Quantum Physics. A Reply to Elise Crull**
Antonio Vassallo, Michael Esfeld
arXiv:1504.02642

Crull (2014) claims that by invoking decoherence it is possible (i) to obviate many "fine grained" issues often conflated under the common designation of measurement problem, and (ii) to make substantial progresses in the fields of quantum gravity and quantum cosmology, without any early incorporation of a particular interpretation in the quantum formalism. We point out that Crull is mistaken about decoherence and tacitly assumes some kind of interpretation of the quantum formalism.